

## PATENT COOPERATION TREATY

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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)


(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 155397.3/TK/hc	<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/EP2005/050599	International filing date (day/month/year) 10.02.2005	Priority date (day/month/year) 10.02.2004	
International Patent Classification (IPC) or national classification and IPC INV. H04Q7/38 H04L29/06			
Applicant FORWARD INFORMATION TECHNOLOGIES SA et al.			

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
  - a. ☒ sent to the applicant and to the International Bureau a total of 6 sheets, as follows:
    - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
    - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
  - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the report
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand  11.08.2005	Date of completion of this report  17.05.2006
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Rüschemann, F  Telephone No. +49 89 2399-7566



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2005/050599

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on
- ☒ the international application in the language in which it was filed
  - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
    - ☐ international search (under Rules 12.3(a) and 23.1(b))
    - ☐ publication of the international application (under Rule 12.4(a))
    - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

1-5, 7-10, 12-55	as originally filed
6, 6a, 11, 11a, 11b	received on 11.08.2005 with letter of 09.08.2005

**Claims, Numbers**

1-45, 46(part), 52-60	as originally filed
46(part), 47-51	received on 11.08.2005 with letter of 09.08.2005

**Drawings, Sheets**

1/32-32/32	as originally filed
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- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	1-60
Inventive step (IS)	Yes: Claims	
	No: Claims	1-60
Industrial applicability (IA)	Yes: Claims	1-60
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

1 Reference is made to the following documents:

D1: EP-A-1 322 089 (ASSIMAKOPOULOS, THEODOROS) 25 June 2003 (2003-06-25)

D2: US 2002/147832 A1 (SAINT-HILAIRE YLIAN ET AL) 10 October 2002 (2002-10-10)

2 **Independent claims 1, 37 and 58 to 60** do not fulfil the requirements of article 33(1), because the subject-matter of **claims 1, 37 and 58 to 60** is neither new nor inventive in the sense of Article 33(2),(3) PCT.

2.1 Document **D1** (see in particular paragraphs 8, 19, 38, 79, 80; figure 5) discloses (applying the terminology of **claim 1** and the references to **D1**), Method for seamless handover of mobile devices in heterogeneous networks in which method a mobile device (paragraph 19, 38) is moved between different topological network locations (paragraphs 8, 19) and transmits and/or receives data by means of different network access technologies (paragraphs 18, 38) without the data transfer between a Client IP application, running on the mobile device, and a Server IP application being interrupted, wherein the Client IP application (paragraph 79; figure 5) of the mobile device makes a request with first data units to a client-service module, and the client-service module (paragraph 79; figure 5) creates second data units based on the received first data units and makes a request to a server-service module with the second data units, and the server-service module (paragraph 80; figure 5) creates third data units based on the received second data units and makes a request to the Server IP application with the third data units to handle the data exchange between the Client IP application and the Server IP application.

Since document **D1** can be read directly on to the subject-matter of present **claim 1**, this subject-matter is not novel and hence **claim 1** does not satisfy the criterion set forth in Article 33(2) PCT.

- 2.2 It is furthermore noted that even if the Applicant would interpret the disclosure of document **D1** in a slightly different manner than the examiner has done in the above analysis, and based on his interpretations would come to the conclusion that there are differences between the subject-matter of present **claim 1** and **D1** which would then establish novelty, then these differences, even if they could be acknowledged as such, would only be of so minor nature that they could not be the basis for establishing the presence of any inventive step, as **D1** discloses the same object and the same type of solution as the present application, and **claim 1** would, even with such a difference in interpretation, not meet the requirements of Article 33(3) PCT.
- 2.3 Additionally, it should be noted that the same objections could have been based on document **D2** (see in particular paragraphs 18, 44, 56 to 66, 75).
- 2.4 **Independent claims 37 and 58 to 60** comprise the same features as claim 1 in form of a system (i.e. a system for seamless handover of mobile devices) and three products (i.e. computer program products). Therefore, the same objections as to claim 1 apply also to **claims 37 and 58 to 60**.

Thus, **claims 30, 46 and 47** do not satisfy the criterion set forth in Article 33(2),(3) PCT.

- 3 The features defined in **dependent claims 2 to 36 and 38 to 57**, in combination with the features of any claim to which they refer, do not add anything of inventive significance to claims 1 and 37, respectively, because they relate to minor technical details which are either in principle directly derivable from above mentioned disclosure of document **D1** (see in particular paragraphs 8, 19, 29 to 40, 69 to 74, 79 to 88, 93, 96, 100, 101, 114, 115, 119 to 127; figures 5, 7) or document **D2** (see in particular paragraphs 3, 14 to 16, 18, 31 to 36, 44, 56 to 75, 82; figures 5 to 7), respectively, or represent simple design details which are generally known to the person skilled in the field of mobility in wireless IP networks.

Due to above reasons, **claims 2 to 36 and 38 to 57** do not satisfy the criterion set forth in Article 33(3) PCT.

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

PCT/EP2005/050599

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- 4     **Claims 1 to 60** fulfil the criterion set forth in Article 33(4) PCT.
  
- 5     When entering the PCT II-phase or a regional phase the following remarks should be taken into account:
  - 5.1   Any independent claim should have been in the correct two-part form recommended by Rule 6.3(b) PCT having a pre-characterizing portion which correctly reflects the prior art disclosed in document **D1**.
  
  - 5.2   Lines 31 and 32 of originally filed page 11 are missing on amended pages.

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As mentioned, in the prior art we can find the following eight patent applications, which can be regarded as representing the prior art for the issue of avoiding the client application shutdown during the wireless network connection switches. These are WO 02/103978 A2 (Swisscom Mobile AG), EP 1 089 495 A2 (Nortel Networks Limited), EP 0 998 094 A2 (Nokia Mobile Phones LTD), WO 03/065682 A1 and WO 03/065654 A1 (KONINKLIJKE PHILIPS ELECTRONICS N.V.), WO 02/43348 A1 (Columbitech AB), EP 1 322 089 A2 (Theodoros Assimakopoulos) and US 2002/0147832 A1 (Saint-Hilaire et al). All these patent applications, except WO 02/43348 A1 and EP 1 322 089 A2, make use of the concept of Mobile IP as described in IP Mobility Support – IETF RFC 2002 (C. Perkins - IBM IP Mobility Support - IETF RFC 2002 - October 1996). Internet makes use of the IP (Internet Protocol) to route data packets (datagrams) from the source to the destination. The source and the destination must have an IP address unique in Internet in order to be reached, something like the telephone number in the telephony world. When the destination address of the data packets is a mobile node this means that a new IP network address must be assigned with each change of network location, which makes transparent mobile accesses impossible. These mobility problems were solved by the Mobile IP standard of the IETF. Mobile IP allows the mobile node to use two IP addresses. One of these addresses is the normal, static IP address (home address), which indicates the location of the home network, whereas the second is a dynamic IP care-of address, which provides information about its current point of attachment to the Internet. The assignment of the two addresses allows the IP data packets to be rerouted to the correct, momentary address of the mobile node. The Mobile IP provides for registering the care-of address with a Home Agent. The Home Agent is normally a fixed network node, which administers the two addresses of the mobile node (home address and care-of address) and reroutes or routes the corresponding data packets: it sends datagrams destined for the mobile node through an IP tunnel to the care-of address. After arriving at the end of the tunnel, each datagram is then delivered to the mobile node.

Unfortunately, the Mobile IP of the IETF does not solve all the mobility problems: if, for instance, a user would like to switch between two different network interfaces while an IP application is running, the IP connection

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is interrupted at the moment when he leaves the old network link. This connection is interrupted at least until the new location, i.e. the new care-of



running the client or the server application and not on different devices. This Session Mobility gives the possibility to handle the security at Session Layer, making possible to provide VPN solutions to enforce strong end-to-end security on an application-to-application level but its major drawback is that it lacks in architectural flexibility, requiring the adapted Session Layer to be installed in  
5 any devices involved in the communication.

The patent application EP 1 322 089 describes an apparatus and a system for dynamically attaching wireless mobile stations to Internet Protocol networks, overcoming various performance problems of the TCP protocol when  
10 used on wireless connections through the introduction of a new single protocol relay station called Mobile Access Router Controller (MARC) between the mobile station (MS) and the correspondent host (CH). This relay station contains a so-called *Socklets server* and a *Protocol Relay* module. The *Socklets Server* on the MARC corresponds to a so-called *Socklets Client* on the  
15 mobile device. The *Socklets Client* replaces the operating system BSD socket API and makes available all methods provided by the original operating system BSD socket API. Thus, all applications continue to work without the need for any modification. The *Socklets Client* intercepts all calls from the mobile device applications before their transmission to the network. The *Socklets Client* then  
20 generates data units called *Socklets-PDU*, encapsulating the original data sent by the applications. These *Socklets-PDUs* are sent on the network connection between the *Socklets Client* on the mobile device and the *Socklets Server* on the MARC using optimised custom layer 2, 3 and 4 protocols and not using the traditional TCP/IP or UDP/IP protocol stack. Once on the MARC, the *Protocol*  
25 *Relay* module uses the *Socklets-PDUs* received from the *Socklets Client* and transformed by the *Socklets Server* to make the traditional TCP(UDP) calls used to establish or destroy sockets with the correspondent host (CH) and to send or receive data to or from it. However, the use of proprietary protocols implies that proprietary equipment has to be used, as Internet routers are not  
30 able to forward the *Socklet-PDUs*. Moreover, a lot of operating system changes make the solution highly platform dependent, while performed OSI layer modification can cause compatibility problems with VPN implementations.

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The patent application US 2002/0147832 discloses a method for framing and processing messages in order to achieve, among other things, the data transmission without loss of information when switching from one network connection to another. The objective of the presented solution is an

5 improvement of the Mobile IP (IETF RFC 2002), which allows a mobile agent to be connected to the home network using the same IP home address regardless of its physical location. This objective is achieved mainly through the introduction of a framing and processing unit on both the mobile agent and the home agent side. These units intercept the traffic between the applications

10 running on the mobile agent and the home applications running on the home network, and perform framing and processing of the information in order to provide services such as resistance to a loss of connection, reliable traffic handoff in the case of a connection switch, stream aggregation, compression, security, quality of service and/or roundtrip and bandwidth optimisation. The framing activity uses a particular protocol, and appends a header to each

15 application fragment in order to be used and transferred between the two units. An improvement of the Mobile IP technique is guaranteed through the introduction of a so-called *Mobility Buffer/ACK* unit that provides a reliable transfer of data also in the case of a network connection switch. This *Mobility*

20 *Buffer/ACK* is used both on the mobile agent and home agent side to store outgoing information until the counterpart acknowledges the successful reception of the information. Finally, a *Firewall Traversal* unit is used on both transmission sides to compress/decompress, encrypt/decrypt and to wrap the information to make it appear as HTTP traffic, so that it can pass through

25 firewalls. The solution according to this US patent application has the same drawbacks as all the solutions based on the Mobile IP concept plus further drawbacks not related to use of Mobile IP, such as a double encapsulation (one due to the Mobile IP and another one due to the framing activity) resulting in an increase of transmission costs due to the additional data to be exchanged and

30 a decrease of the throughput due to the IP fragmentation problems. In addition, the use of the described *Firewall Traversal* unit adds a further encapsulation level needed for wrapping the data in order to make it appear as HTTP traffic. This solution introduces a second level of reliability to the TCP/IP reliability

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mechanism, already based on the reception of an acknowledgement by the sender in order to consider the transmission successfully done. This second reliability level reduces considerably the throughput of the connection, especially in the case of wireless connections with high latency and thus with high round trip time, as the sender has to wait for both the first (regular TCP) and the second level acknowledgement in order to consider the transmission successfully completed.

Finally the mentioned document "Supporting CORBA Applications in a Mobile Environment" MOBICOM '99 by HAAHR M et al. is only one of the numerous solutions providing the seamless handover by offering to the client and server application developers a software framework with a set of API to be used. The major drawback of this kind of solutions is the backward compatibility. The seamless handover can be granted only if the client and server applications have been developed using the provided software framework. All the already developed and largely used client and server applications can't enjoy the seamless mobility.

### Summary of the Invention

It is an object of this invention to propose a new method and system for seamless handover of mobile devices in heterogeneous networks. In particular the switching from one network connection to another should be carried out without interruption of the IP applications and makes possible an uninterrupted continuation of the program course also with real-time applications, if applicable, without being dependent upon specific protocols or network technologies or operating systems. Therefore, it is an object of this invention to provide a method and a system capable of managing, without being dependent upon different protocols or network technologies or operating systems, an automatic/semi-automatic and transparent handover between different network access technologies and/or access providers without interrupting active network applications or sessions.

This object is attained according to the present invention through the elements of the independent claims. Further preferred embodiments follow, moreover, from the dependent claims and from the description.

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IP application (11) and bound to the IP address provided by a first physical interface used to communicate with the Client IP application (11), and a client application emulation interface composed of sockets and server sockets used to exchange data with the server-service module (22) and bound to the IP  
5 address provided by a second physical interface currently selected by the client-service module (12).

47. System according to the claim 44 or 46, characterised in that the server-service module (22) comprises at least a server application emulation interface composed of sockets and server sockets used to exchange data with  
10 the client-service module (12) and a client application emulation interface composed of sockets and server sockets used to exchange data with the Server IP application (21).

48. System according to the claim 47, characterised in that a plurality of client-service modules (12) of two or more mobile devices, providing client  
15 service emulator server sockets on the same ports, is connected to the same server-service module (22) and the client application emulation interface sockets of the server-service module (22) are bound to different Virtual IP addresses created and/or allocated by it.

49. System according to any one of the claims 37 to 48,  
20 characterised in that the system comprises the server-service module (22) installed on the same device (20) as the Server IP application (21).

50. System according to any one of the claims 37 to 48,  
characterised in that the system comprises the server-service module (22)  
installed on a different device of the same network as the device (20) running  
25 the Server IP application (21).

51. System according to any one of the claims 37 to 48,  
characterised in that the system comprises the server-service module (22)  
installed on any Internet node.